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ABSTRACT

An important feature of the National Assessment of Educational Progress (NAEP) is its ability to document trends in academic achievement on core curriculum areas over an extended period of time. This report presents the major results of the NAEP 1996 science, mathematics, reading, and writing long-term assessments. These results chart trends going back to the first year in which each NAEP assessment was given: 1969-1970 in science, 1973 in mathematics, 1971 in reading, and 1984 in writing. Trends in average performance over these periods are discussed for students at ages 9, 13, and 17 for science, mathematics, and reading, and for grades 4, 8, and 11 for the writing assessment. Trends in average performance differences between White and Black Students, White and Hispanic students, and male and female students are also discussed. In general, the trends in science and mathematics show early declines or relative stability followed by improved performance. In reading and writing the results are somewhat mixed; although some modest improvement is evident in the trend for reading assessments, few indications of positive trends were evident in the writing results. More in-depth understanding is achieved by examining the types of abilities associated with different levels on the NAEP scale and the percentages of students who have gained these levels across the trend assessment. This information is summarized. (Contains four figures and nine tables.) (SLD)

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ED 411 327

NATIONAL CENTER FOR EDUCATION STATISTICS

Report in Brief

NAEP 1996 Trends in Academic Progress

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THE NATION'S REPORT CARD, the National Assessment of Educational Progress (NAEP), is the only nationally representative and continuing assessment of what America's students know and can do in various subject areas. Since 1969, assessments have been conducted periodically in reading, mathematics, science, writing, history/geography, and other fields. By making objective information on student performance available to policymakers at the national, state, and local levels, NAEP is an integral part of our nation's evaluation of the condition and progress of education. Only information related to academic achievement is collected under this program. NAEP guarantees the privacy of individual students and their families.

NAEP is a congressionally mandated project of the National Center for Education Statistics, the U.S. Department of Education. The Commissioner of Education Statistics is responsible, by law, for carrying out the NAEP project through competitive awards to qualified organizations. NAEP reports directly to the Commissioner, who is also responsible for providing continuing reviews, including validation studies and solicitation of public comment, on NAEP's conduct and usefulness.

In 1988, Congress established the National Assessment Governing Board (NAGB) to formulate policy guidelines for NAEP. The Board is responsible for selecting the subject areas to be assessed from among those included in the National Education Goals; for setting appropriate student performance levels; for developing assessment objectives and test specifications through a national consensus approach; for designing the assessment methodology; for developing guidelines for reporting and disseminating NAEP results; for developing standards and procedures for interstate, regional, and national comparisons; for determining the appropriateness of test items and ensuring they are free from bias; and for taking actions to improve the form and use of the National Assessment.

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NATIONAL CENTER FOR EDUCATION STATISTICS

Report in Brief

NAEP 1996 Trends in Academic Progress

Achievement of U.S. Students in

• Science, 1969 to 1996 • Mathematics, 1973 to 1996

• Reading, 1971 to 1996 • Writing, 1984 to 1996

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August 1997

U.S. Department of Education
Office of Educational Research and Improvement **NCES 97-986**

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Introduction

As we approach the year 2000, efforts to increase the academic achievement of students and to prepare them for the 21st century have become a primary focus of parents, educators, and policy makers. During the 1990s, educational reform and increased expectations for all students to achieve their highest potential have been the hallmark of policies and programs set forth at the national, state, and district levels. In 1990, the President and governors adopted a set of six ambitious national education goals for the 21st century: ensuring that children start school ready to learn, raising high school graduation rates, increasing levels of education achievement, promoting science and mathematics achievement as well as literacy and lifelong learning, and freeing schools of drugs and violence.[1] Congress broadened these goals in 1994 to include improvements in teacher preparation and increased parental involvement in schools.[2] In 1997, the President strengthened the nation's commitment to rigorous education standards by proposing a voluntary program of national tests in reading at grade 4 and in mathematics at grade 8 to ensure that individual students across the country are provided equal opportunities to achieve high standards in these critical subject areas.

As new policies are implemented and changes in educational practices occur, information about trends in student achievement across time is critical for educators and policy makers to observe the overall effects of reform efforts. Measuring students' progress toward higher achievement has been the purpose of the National Assessment of Educational Progress (NAEP) since its inception in 1969. Students in both public and nonpublic schools have been assessed in various subject areas on a regular basis. In addition, NAEP collects information about relevant background variables that provide a meaningful context for interpreting the assessment results and for documenting the extent to which educational reform has been implemented.

The NAEP Long-Term Trend Assessments

One important feature of NAEP is its ability to document trends in academic achievement in core curriculum areas over an extended period of time. By administering materials and replicating procedures from assessment to assessment, NAEP collects valuable information about progress in academic achievement and about whether the United States can meet the challenge of its national education goals.

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[1] Executive Office of the President. (1990). *National goals for education.* Washington, DC: U.S. Government Printing Office.

[2] Goals 2000: Educate America Act, Pub. L. No. 102-227 (1994).

The NAEP long-term trend assessments are separate from a series of newer NAEP assessments (called "main" assessments) that involve more recently developed instruments. While the long-term trend assessments have used the same sets of questions and tasks so that trends across time can be measured, the main assessments in each subject area have been developed to reflect current educational content and assessment methodology. In some cases, the main assessment in a particular subject area has been administered in more than one year, providing short-term trend results (e.g., mathematics in 1990, 1992, and 1996; and reading in 1992 and 1994). The use of both long-term trend and main assessments allows NAEP to provide information about students' achievement over time and to evaluate their attainment of more contemporary educational objectives. As each assessment is based on a different set of questions and tasks, scale score results and students' reports of educationally related experiences from the long-term trend assessments cannot be directly compared to the main assessments.

This report presents the major results of the NAEP 1996 science, mathematics, reading, and writing long-term trend assessments. (A more complete presentation of the 1996 long-term trend results is provided in the full report, *NAEP 1996 Trends in Academic Achievement*.[3]) These results chart trends going back to the first year in which each NAEP assessment was given: 1969/1970 in science, 1973 in mathematics, 1971 in reading, and 1984 in writing. Trends in average performance over these time periods are discussed for students at ages 9, 13, and 17 for the science, mathematics, and reading assessments, and for students in grades 4, 8, and 11 for the writing assessment. Trends in average performance differences between White students and Black students, White students and Hispanic students, and male and female students are also discussed.

Analysis Procedures

To provide a numeric summary of students' performance on assessment questions and tasks, NAEP uses a 0-to-500 scale for each subject area. Comparisons of average scale scores are provided across the years in which trend assessments have been administered and among subpopulations of students. Nationally representative samples totaling approximately 30,000 students were involved in the NAEP 1996 trend assessments.

The descriptions of trend results are based on the results of statistical tests that consider both the estimates of average performance in each assessment year as well as the degree of uncertainty associated with these estimates. The purpose of basing descriptions on such tests is to restrict the discussion of observed trends and group differences to those that are statistically dependable. Hence, the patterns of results that are discussed are unlikely to be due to the chance factors associated with the inevitable sampling and measurement errors inherent in any large-scale survey effort like NAEP. Throughout this report, all descriptions of trend patterns, differences between assessment years, and differences between subgroups of students which are cited are statistically significant at the .05 level.

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[3] Campbell, J.R., Voelkl, K.E., and Donahue, P.L. (1997). *NAEP 1996 Trends in Academic Achievement*. National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Two distinct sets of statistical tests were applied to the trend results. The purpose of the first set of tests was to determine whether the results of the *series* of assessments in a given subject could be generally characterized by a line or a simple curve. Simple linear and curvilinear (or quadratic) patterns do not always provide a satisfactory summary description of the patterns of trend results. Hence, a second set of statistical tests were conducted which compared results for selected pairs of assessment years within each trend sequence. Two families of pairwise tests were carried out. One family of tests consisted of comparing the results from the first assessment year (base year) to the 1996 results. The second family of tests consisted of comparing the results from the previous assessment year (1994) to the 1996 results. It should be noted that statistically significant changes in student performance across a two-year period may be unlikely and, in fact, are not evident in the overall results or in the results for most subgroups of students presented in this report. Changes in the average achievement of populations and subpopulations are more likely to occur over extended periods of time. In addition, the inherent uncertainty associated with estimates of performance based on samples rather than entire populations necessitates consideration of standard errors in comparing assessment results, further constraining the likelihood that the magnitude of change which may occur between two years will be statistically significant. The characterizations of trend data that appear in this report are based on the combined results of both the general tests and the two families of pairwise tests.

The results of each type of statistical test are presented in small grids that appear next to or below each of the figures in this report that display data for each assessment year. The results from tests comparing the base year and 1996 assessments are summarized in the column labeled with the asterisk symbol "*." Significant differences are denoted with a "+" or "-" sign indicating that the 1996 average score was either greater than or less than the base year score, respectively. Similarly, significant differences between 1994 and 1996 assessment results are denoted with a "+" or "-" sign under the column labeled with the dagger symbol "‡" indicating that the 1996 average score was either greater or smaller than the 1994 average, respectively. The results from the linear and quadratic trend tests are summarized in the columns labeled "L" and "Q," respectively. Within each column, significant positive trends are denoted by a "+" sign and significant negative trends are denoted with a "-" sign. In tables where only the first and most recent assessment results are presented, significant differences between the base year and 1996 are indicated within the tables.

National Trends in Average Scale Scores

The national trends in science, mathematics, reading, and writing achievement are presented in Figure 1. In general, the trends in science and mathematics show early declines or relative stability followed by improved performance. In reading and writing, the results are somewhat mixed; although some modest improvement was evident in the trend reading assessments, few indications of positive trends were evident in the writing results.

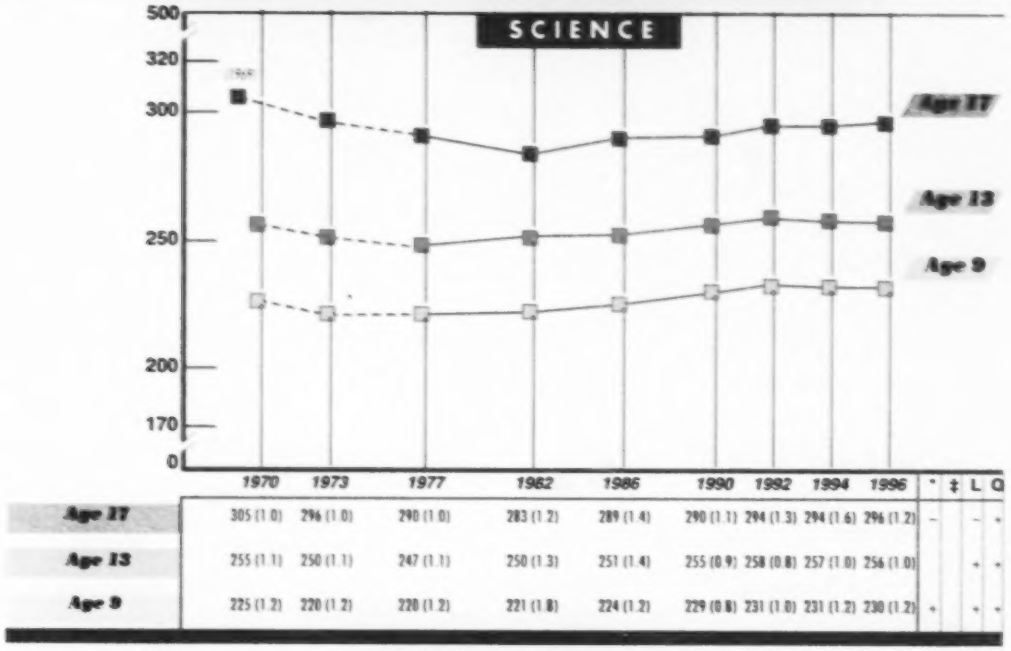
Science. The overall pattern of performance in science for 9-, 13-, and 17-year-olds is one of early declines followed by a period of improvements. Among 17-year-old students, declines in performance that were observed from 1969 to 1982 were reversed, and the trend has been toward higher average science scores since that time. Despite these recent gains, the overall trend was negative, and the 1996 average score remained lower than the 1969 average. After a period of declining performance from 1970 to 1977, the trend for 13-year-olds has been one of increasing scores. Although the overall linear trend was positive, there was no significant difference between the 1996 and 1970 average scores for these students. Except for the decline from 1970 to 1973 in average science scores for 9-year-olds, the overall trend shows improved performance, and the 1996 average score for these students was higher than that in 1970.

Mathematics. At all three ages, trend results indicate overall improvement in mathematics across the assessment years. Among 17-year-olds, declining performance during the 1970s and early 1980s was followed by a period of moderate gains. Although the overall pattern is one of increased performance, the average score in 1996 was not significantly different from that in 1973. The performance of 13-year-olds across the trend assessments shows overall improvement, resulting in a 1996 average score that was higher than the 1973 average. After a period of relative stability during the 1970s and early 1980s, the average score for 9-year-olds increased. The overall trend for this age group was one of improved performance, and the average score in 1996 was higher than in 1973.

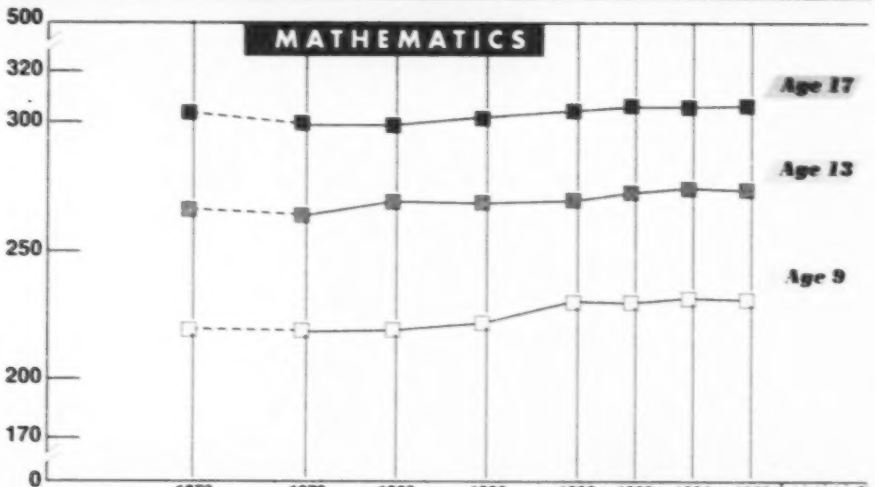
Reading. At age 17, the pattern of increases in average reading scores from 1971 to 1988 was not sustained into the 1990s. Although the overall pattern is one of improved performance across the assessment years, the average score of 17-year-olds in 1996 was not significantly different from that of their counterparts in 1971. Thirteen-year-olds have shown moderate gains across the trend assessments, and in 1996 attained an average score that was higher than that in 1971. The performance of 9-year-olds improved from 1971 to 1980, but declined slightly since that time. However, in 1996 the average score for these students remained higher than that of their counterparts in 1971.

Writing. Among eleventh graders, an overall pattern of declining performance is evident in the average writing scores across the assessment years. In 1996, the average score attained by these students was lower than that in 1984. The average writing score of eighth graders has fluctuated, reaching a low point in 1990 and rebounding in 1992. However, no consistent pattern of increases or decreases across the assessments was evident, and the 1996 average score for these students did not differ significantly from that of their counterparts in 1984. At grade 4, no significant changes were observed in students' average writing scores from 1984 to 1996.

Figure 1 Trends in Average Scale Scores for the Nation



	1970	1973	1977	1982	1986	1990	1992	1994	1996	*	‡	L	Q
Age 17	305 (1.0)	296 (1.0)	290 (1.0)	283 (1.2)	289 (1.4)	290 (1.1)	294 (1.3)	294 (1.6)	296 (1.2)	-		-	+
Age 13	255 (1.1)	250 (1.1)	247 (1.1)	250 (1.3)	251 (1.4)	255 (0.9)	258 (0.8)	257 (1.0)	256 (1.0)			+	+
Age 9	225 (1.2)	220 (1.2)	220 (1.2)	221 (1.8)	224 (1.2)	229 (0.8)	231 (1.0)	231 (1.2)	230 (1.2)	+		+	+



	1973	1978	1982	1986	1990	1992	1994	1996	*	‡	L	Q
Age 17	304(1.1)	300(1.0)	299(0.9)	302(0.9)	305(0.9)	307(0.9)	306(1.0)	307(1.2)			+	+
Age 13	266(1.1)	264(1.1)	269(1.1)	269(1.2)	270(0.9)	273(0.9)	274(1.0)	274(0.8)	+		+	
Age 9	219(0.8)	219(0.8)	219(1.1)	222(1.0)	230(0.8)	230(0.8)	231(0.8)	231(0.8)	+		+	+

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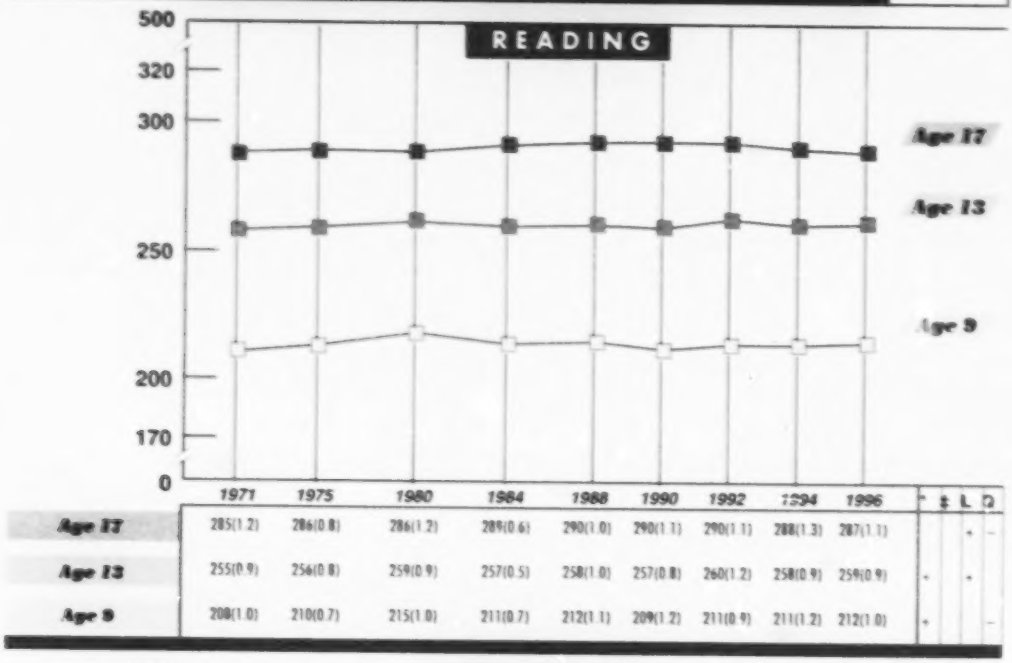
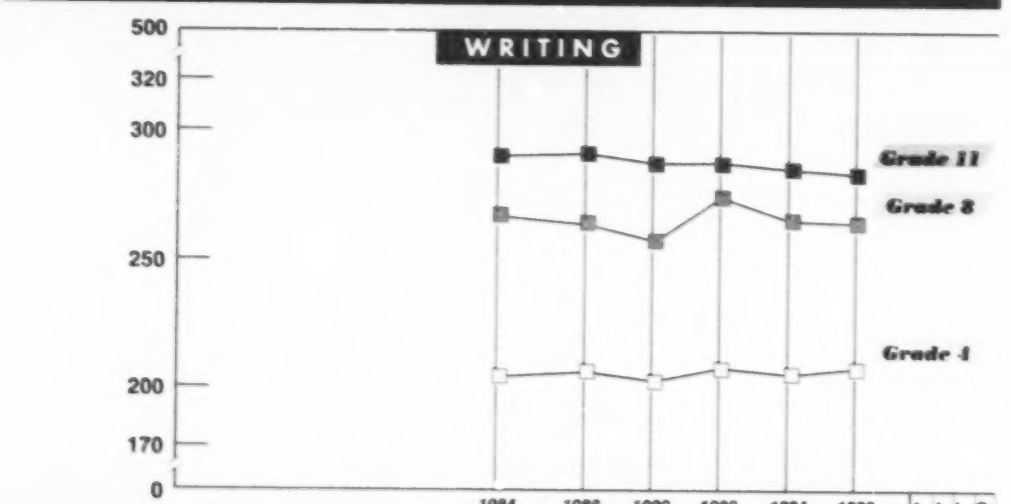
Figure 1 (continued)

Trends in Average Scale Scores for the Nation



	1971	1975	1980	1984	1988	1990	1992	1994	1996	*	‡	L	Q
Age 17	285(1.2)	286(0.8)	286(1.2)	289(0.6)	290(1.0)	290(1.1)	290(1.1)	288(1.3)	287(1.1)			+	–
Age 13	255(0.9)	256(0.8)	259(0.9)	257(0.5)	258(1.0)	257(0.8)	260(1.2)	258(0.9)	259(0.9)	+		+	
Age 9	208(1.0)	210(0.7)	215(1.0)	211(0.7)	212(1.1)	209(1.2)	211(0.9)	211(1.2)	212(1.0)	+			–



	1984	1988	1990	1992	1994	1996	*	‡	L	Q
Grade 11	290(1.6)	291(1.3)	287(1.0)	287(1.4)	285(1.2)	283(1.2)	–		–	
Grade 8	267(2.0)	264(1.3)	257(1.2)	274(1.3)	265(1.3)	264(1.0)				
Grade 4	204(1.5)	206(1.6)	202(1.5)	207(1.5)	205(1.6)	207(1.2)				

Standard errors of the estimated scale scores appear in parentheses. [– – –] Extrapolated from previous NAEP analyses.

* Indicates that the average scale score in 1996 is significantly larger (+) or smaller (–) than that in the first assessment year.

‡ Indicates that the average scale score in 1996 is significantly larger (+) or smaller (–) than that in 1994.

L Indicates that the positive (+) or negative (–) linear trend is significant.

Q Indicates that the positive (+) or negative (–) quadratic trend is significant.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Long-Term Trend Assessment.

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Trends in Levels of Performance

A more in-depth understanding of students' academic progress across time can be gained by examining the types of abilities associated with different levels on the NAEP scale and the percentages of students who have attained those levels of performance across the trend assessments. Five levels of performance have been identified and described on the NAEP scale for each subject area: 150, 200, 250, 300, and 350.[4] The procedure for describing the five performance levels was the same in science, mathematics, and reading. Sets of questions were identified that were more likely to be answered correctly by students at one level than by those at the next lower level. Educators and curriculum experts representing each of the subject areas then carefully studied the sets of questions to develop descriptions for the five levels. These descriptions outline the concepts, skills, or processes demonstrated by correct responses to the questions at each level.

The procedure for describing the writing performance levels was somewhat different. Because the NAEP writing assessment is a direct measure of students' writing abilities, it does not contain questions or tasks that can be scored as correct or incorrect. Instead, students' responses to the writing tasks are rated according to the extent of task accomplishment. The descriptions of the five writing performance levels were developed by examining the ratings received by students whose overall performance was at one level in comparison to the ratings received by students at the next lower level.

Information about trends in students' attainment of performance levels is available back to 1977 in science, 1978 in mathematics, 1971 in reading, and 1984 in writing. Tables 1 through 4 present the percentages of students performing at or above each of the five levels in the first assessment year for which performance level data are available and in the 1996 assessment. In addition, the tables provide summary descriptions that characterize students' performance at each level.

Science. At age 9, the percentages of students attaining at least Levels 150, 200, 250, and 300 on the science scale increased between 1977 and 1996. Increases were also apparent in the percentages of 13-year-olds attaining at least Levels 150, 200, and 250. Although no significant increases were observed for 17-year-olds at the lower levels, the vast majority of students in this age group demonstrated the skills associated with these levels in both 1977 and 1996. At the two highest performance levels, 300 and 350, there was an increase between 1977 and 1996.

Mathematics. Similar to trends observed in science, the percentages of 9-year-olds at or above Levels 150, 200, 250, and 300 on the mathematics scale were higher in 1996 than in 1978. At age 13, nearly all students attained at least Levels 150 and 200 in both 1978 and 1996. There was an increase between the two assessment years in the percentages of 13-year-olds at or above Levels 200 and 250. Among 17-year-olds, performance at or above Levels 150, 200, and 250 was attained by nearly all students in both 1978 and 1996. The percentage of 17-year-old students reaching at least Levels 250 and 300 was higher in 1996 than in 1978.

[4] In theory, performance levels above 350 and below 150 could have been defined; however, so few students in the assessment performed at the extreme ends of the subject-area scales that it was not practical to do so.

Reading. In comparison to the assessment results in 1971, greater percentages of 9-year-olds in 1996 attained at least Levels 150, 200, and 250 on the reading scale. At age 13, most students performed at or above the two lowest levels, 150 and 200, in both 1971 and 1996. Increases were observed between the two assessment years in the percentages of 13-year-olds performing at or above Levels 250, 300, and 350. The vast majority of 17-year-olds attained at least Levels 150, 200 and 250 in both 1971 and 1996. The percentages of 17-year-old students at or above Levels 200 and 250 were higher in 1996 than in 1971.

Writing. At grade 4, the percentages of students attaining each of the performance levels on the writing scale in 1996 were not significantly different from those in 1984. Nearly all eighth graders performed at or above Levels 150 and 200 in both 1984 and 1996. However, the percentages of students in grade 8 who attained at least Levels 200 and 250 in 1996 were lower than the percentages in 1984. Almost all eleventh graders reached at least Levels 150 and 200, and the vast majority reached at least Level 250, in both 1984 and 1996. However, there was a decrease between the two assessment years in the percentages of students at grade 11 who demonstrated performance at or above Levels 250 and 300.

Table 1 **Percentages of Students Performing At or Above Science Performance Levels, Ages 9, 13, and 17, 1977 and 1996**

Level		AGE 9		AGE 13		AGE 17	
		Percent in 1977	Percent in 1996	Percent in 1977	Percent in 1996	Percent in 1977	Percent in 1996
350	Can infer relationships and draw conclusions using detailed scientific knowledge	0 (0.0)	0 (0.1)	1 (0.1)	0 (0.2)	9 (0.4)	11 (0.9) *
300	Has some detailed scientific knowledge and can evaluate the appropriateness of scientific procedures	3 (0.3)	4 (0.5) *	11 (0.5)	12 (0.6)	42 (0.9)	49 (1.3) *
250	Understands and applies general information from the life and physical sciences	26 (0.7)	32 (1.2) *	49 (1.1)	58 (1.2) *	82 (0.7)	84 (0.9)
200	Understands some simple principles and has some knowledge, for example, about plants and animals	68 (1.1)	76 (1.0) *	86 (0.7)	92 (0.6) *	97 (0.2)	98 (0.3)
150	Knows everyday science facts	94 (0.6)	97 (0.5) *	99 (0.2)	100 (0.1) *	100 (0.0)	100 (***)

Standard errors of the estimated percentages appear in parentheses. When no standard error appears (***), standard error estimates may not be accurately determined and/or the sampling distribution of the statistic does not match statistical test assumptions. In these cases statistical tests have not been conducted.

* Indicates that the percentage in 1996 is significantly different than that in 1977.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Long-Term Trend Assessment.

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Table 2 **Percentages of Students Performing At or Above Mathematics Performance Levels, Ages 9, 13, and 17, 1978 and 1996**

Level		AGE 9		AGE 13		AGE 17	
		Percent in 1978	Percent in 1996	Percent in 1978	Percent in 1996	Percent in 1978	Percent in 1996
350	Can solve multistep problems and use beginning algebra	0 (***)	0 (***)	1 (0.2)	1 (0.1)	7 (0.4)	7 (0.8)
300	Can compute with decimals, fractions, and percents; recognize geometric figures; solve simple equations; and use moderately complex reasoning	1 (0.1)	2 (0.3) *	18 (0.7)	21 (1.2)	52 (1.1)	60 (1.7) *
250	Can add, subtract, multiply, and divide using whole numbers, and solve one-step problems	20 (0.7)	30 (1.0) *	65 (1.2)	79 (0.9) *	92 (0.5)	97 (0.4) *
200	Can add and subtract two-digit numbers and recognize relationships among coins	70 (0.9)	82 (0.8) *	95 (0.5)	99 (0.2) *	100 (0.1)	100 (***)
150	Knows some addition and subtraction facts	97 (0.3)	99 (0.2) *	100 (0.1)	100 (***)	100 (***)	100 (***)

Standard errors of the estimated percentages appear in parentheses. When no standard error appears (***), standard error estimates may not be accurately determined and/or the sampling distribution of the statistic does not match statistical test assumptions. In these cases statistical tests have not been conducted.

* Indicates that the percentage in 1996 is significantly different than that in 1978.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Long-Term Trend Assessment.

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Table 3 **Percentages of Students Performing At or Above Reading Performance Levels, Ages 9, 13, and 17, 1971 and 1996**

Level		AGE 9		AGE 13		AGE 17	
		Percent in 1971	Percent in 1996	Percent in 1971	Percent in 1996	Percent in 1971	Percent in 1996
350	Can synthesize and learn from specialized reading materials	0 (***)	0 (***)	0 (0.0)	1 (0.2) *	7 (0.4)	6 (0.8)
300	Can find, understand, summarize, and explain relatively complicated information	1 (0.1)	1 (0.3)	10 (0.5)	14 (1.0) *	39 (1.0)	39 (1.4)
250	Can search for specific information, interrelate ideas, and make generalizations	16 (0.6)	18 (0.8) *	58 (1.1)	61 (1.3) *	79 (0.9)	81 (0.9) *
200	Can comprehend specific or sequentially related information	59 (1.0)	64 (1.2) *	93 (0.5)	93 (0.6)	96 (0.3)	97 (0.5) *
150	Can carry out simple, discrete reading tasks	91 (0.5)	93 (0.7) *	100 (0.0)	100 (0.1)	100 (0.1)	100 (***)

Standard errors of the estimated percentages appear in parentheses. When no standard error appears (***), standard error estimates may not be accurately determined and/or the sampling distribution of the statistic does not match statistical test assumptions. In these cases statistical tests have not been conducted.

* Indicates that the percentage in 1996 is significantly different than that in 1971.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Long-Term Trend Assessment.

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Table 4 **Percentages of Students Performing At or Above Writing Performance Levels, Grades 4, 8, and 11, 1984 and 1996**

Level		GRADE 4		GRADE 8		GRADE 11	
		Percent in 1984	Percent in 1996	Percent in 1984	Percent in 1996	Percent in 1984	Percent in 1996
350	Can write effective responses containing supportive details and discussion	0 (***)	0 (***)	0 (***)	1 (0.2)	2 (0.7)	2 (0.5)
300	Can write complete responses containing sufficient information	1 (***)	1 (0.2)	13 (1.8)	16 (0.8)	39 (2.4)	31 (1.5) *
250	Can begin to write focused and clear responses to tasks	10 (1.0)	13 (1.2)	72 (2.6)	66 (1.3) *	89 (1.0)	83 (1.4) *
200	Can write partial or vague responses to tasks	54 (2.0)	59 (1.5)	98 (0.9)	96 (0.5) *	100 (0.3)	99 (0.2)
150	Can respond to tasks in abbreviated, disjointed, or unclear ways	93 (1.3)	93 (0.7)	100 (***)	100 (0.1)	100 (***)	100 (***)

Standard errors of the estimated percentages appear in parentheses. When no standard error appears (***), standard error estimates may not be accurately determined and/or the sampling distribution of the statistic does not match statistical test assumptions. In these cases statistical tests have not been conducted.

* Indicates that the percentage in 1996 is significantly different than that in 1984.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Long-Term Trend Assessment.

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Trends in Differences in Average Scale Scores Between Racial/Ethnic Groups of Students and Between Males and Females

As noted earlier, one of the national educational goals calls for increases in students' academic achievement. A stated objective of this goal is that the performance distribution for minority students will more closely reflect that of the student population as a whole.[3] In some of the subject areas assessed by NAEP, results indicated progress toward meeting this goal. Trends in the differences between average scores for subgroups of students are presented below.

Differences between White and Black Students. Although in 1996 White students attained higher average scores than their Black peers in each age group across the four subject areas, there was some indication that the gaps between White and Black students' average scores in science, mathematics, and reading have narrowed across the assessment years. Despite some fluctuations, however, the trend in writing scale score gaps demonstrates no consistent pattern of increases or decreases at any grade level.

In science, the trend toward smaller gaps among 17-year-olds is due predominately to a one-time decrease in the gap between 1982 and 1986. However, the gap in 1996 was not significantly different from that in 1969. The narrowing of the gap between average scores of White and Black students aged 9 and 13 occurred in the late 1970s or 1980s. Although there has been little change in the 1990s, the gaps for both 9- and 13-year-olds in 1996 were smaller than those in 1970.

In mathematics and reading, scale score gaps between White and Black students aged 13 and 17 narrowed during the 1970s and 1980s. Although there was some evidence of widening gaps during the late 1980s and 1990s, the scale score gaps in 1996 were smaller than those in the first assessment year for 13- and 17-year-olds in mathematics and for 17-year-olds in reading. Among 9-year-olds, scale score gaps in mathematics and reading have generally decreased across the assessment years, resulting in smaller gaps in 1996 compared to those in the first assessment year.

[3] Executive Office of the President. (1990). *National goals for education.* Washington, DC: U.S. Government Printing Office.

Figure 2

Trends in Differences in Average Scale Scores
White vs. Black Students

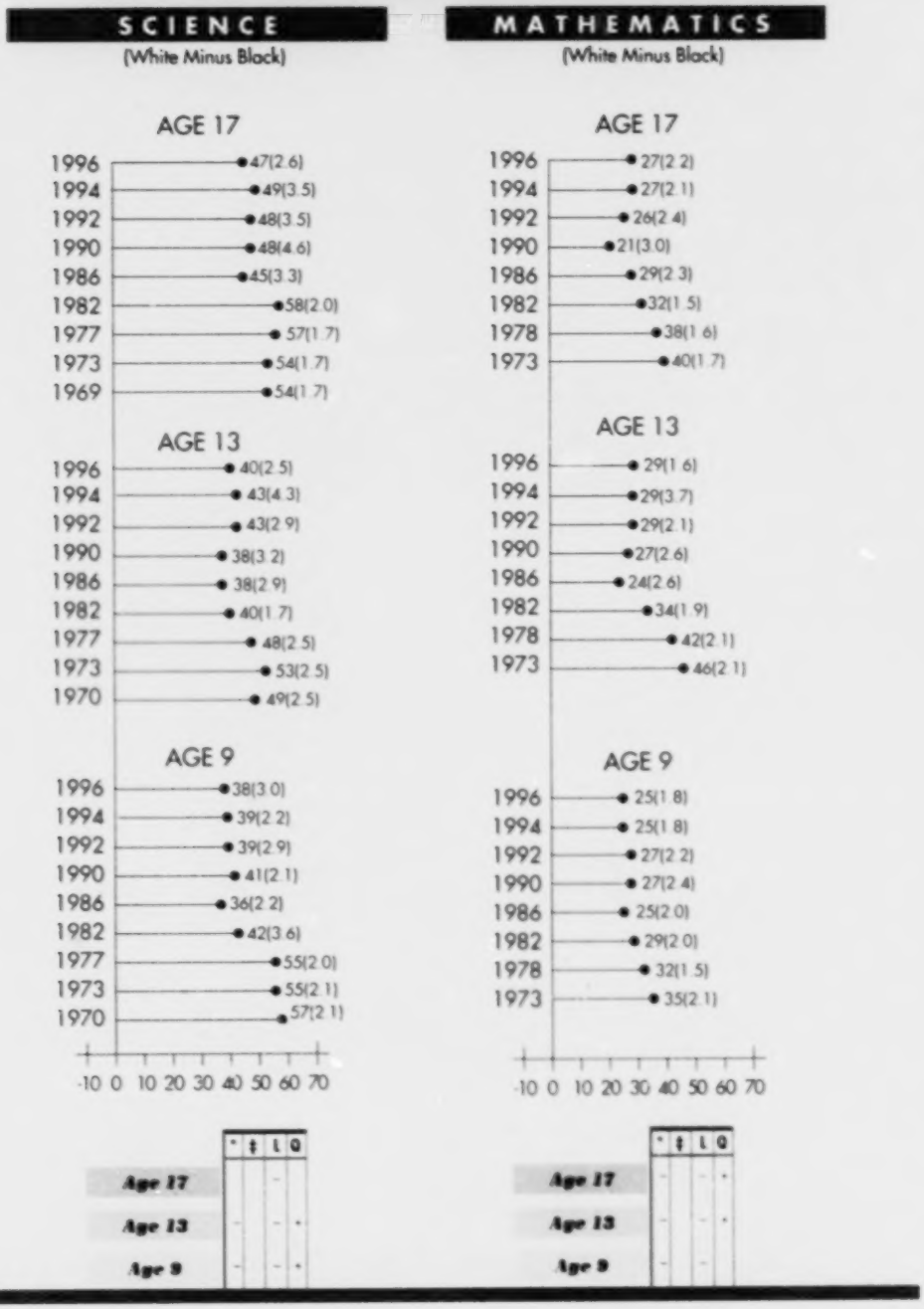

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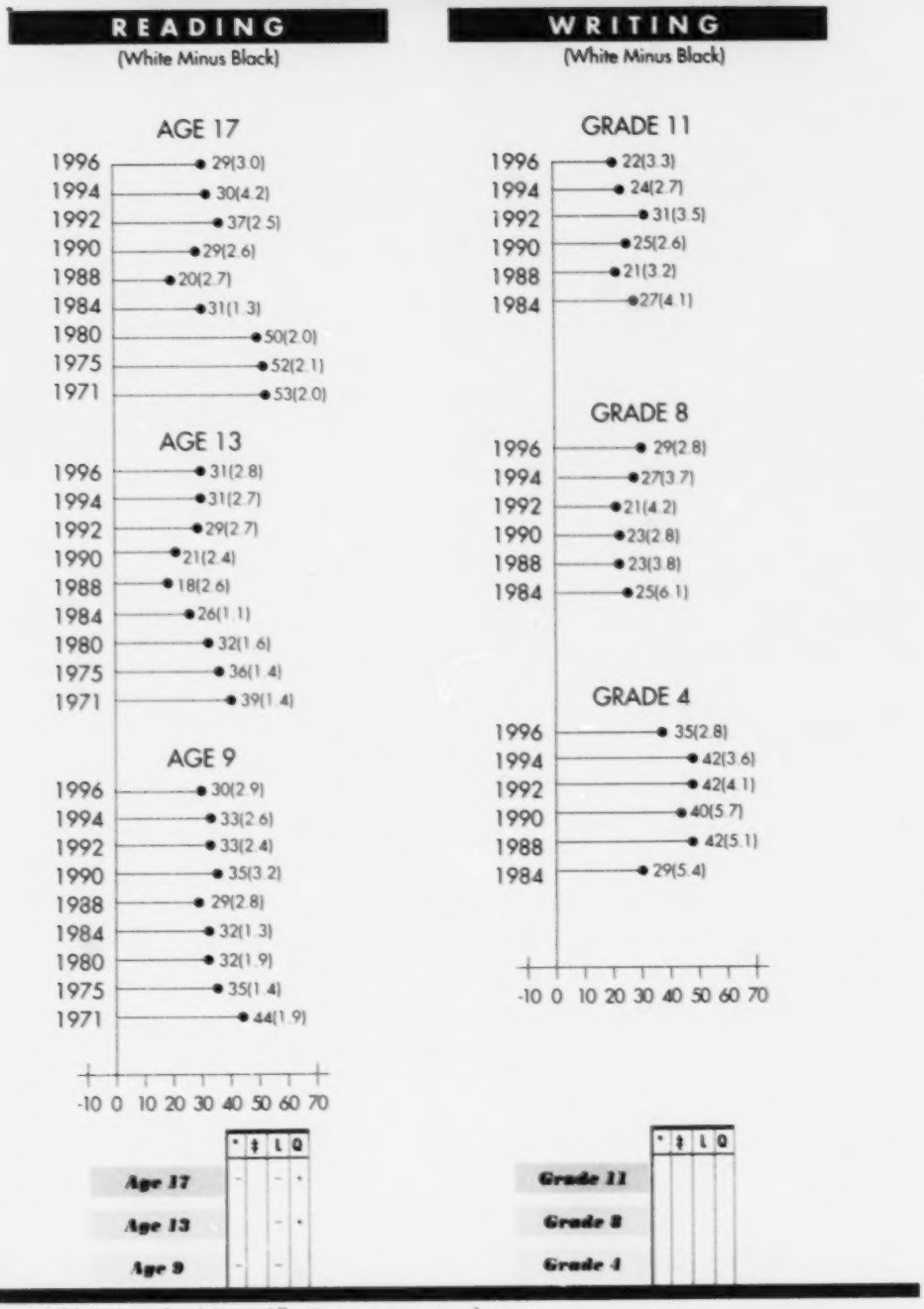
Figure 2 (continued)

Trends in Differences in Average Scale Scores
White vs. Black Students



Standard errors of the estimated scale score differences appear in parentheses.

* Indicates that the average scale score difference in 1996 is significantly larger (+) or smaller (–) than that in the first assessment year.

‡ Indicates that the average scale score difference in 1996 is significantly larger (+) or smaller (–) than that in 1994.

L Indicates that the positive (+) or negative (–) linear trend is significant.

Q Indicates that the positive (+) or negative (–) quadratic trend is significant.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Long-Term Trend Assessment.

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Differences between White and Hispanic Students. In 1996, White students had higher average scores than Hispanic students at all three ages in each of the four subject areas. In science, mathematics, and reading, some significant changes in the magnitude of the gap between White and Hispanic students' average scores have occurred across the assessment years. However, no consistent pattern of increases or decreases is evident in the writing scale score gaps.

In science, there was some evidence that the gap between White and Hispanic 13-year-olds' average scores decreased between 1977 and 1982, but the gap has changed little since that time. The gap in 1996 among 13-year-olds was not significantly different from that in 1977.

In mathematics, the gap among 17-year-olds has generally decreased across the assessment years, resulting in a gap in 1996 that was lower than that in 1973. At age 13, the gap in mathematics scores decreased from 1973 to 1986. Although the gap appears to have widened somewhat since that time, the gap in 1996 was smaller than that in 1973.

In reading, scale scores gaps among 17-year-olds decreased from 1975 to 1990. However, recent assessment results revealed some widening of the gap, and in 1996 the gap was not significantly different from that in 1975.

Figure 3

Trends in Differences in Average Scale Scores
White vs. Hispanic Students

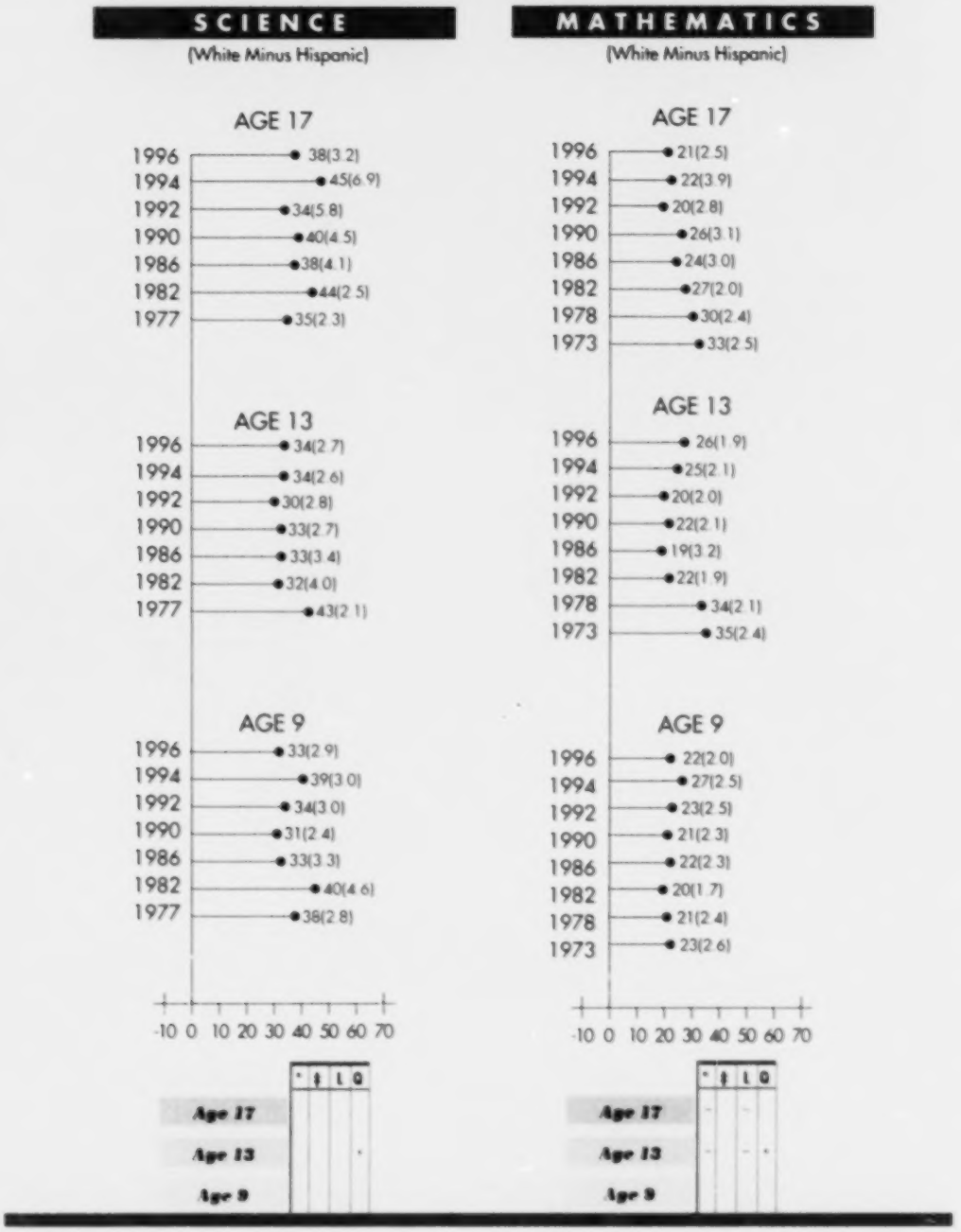

Figure 3 (continued)

Trends in Differences in Average Scale Scores
White vs. Hispanic Students

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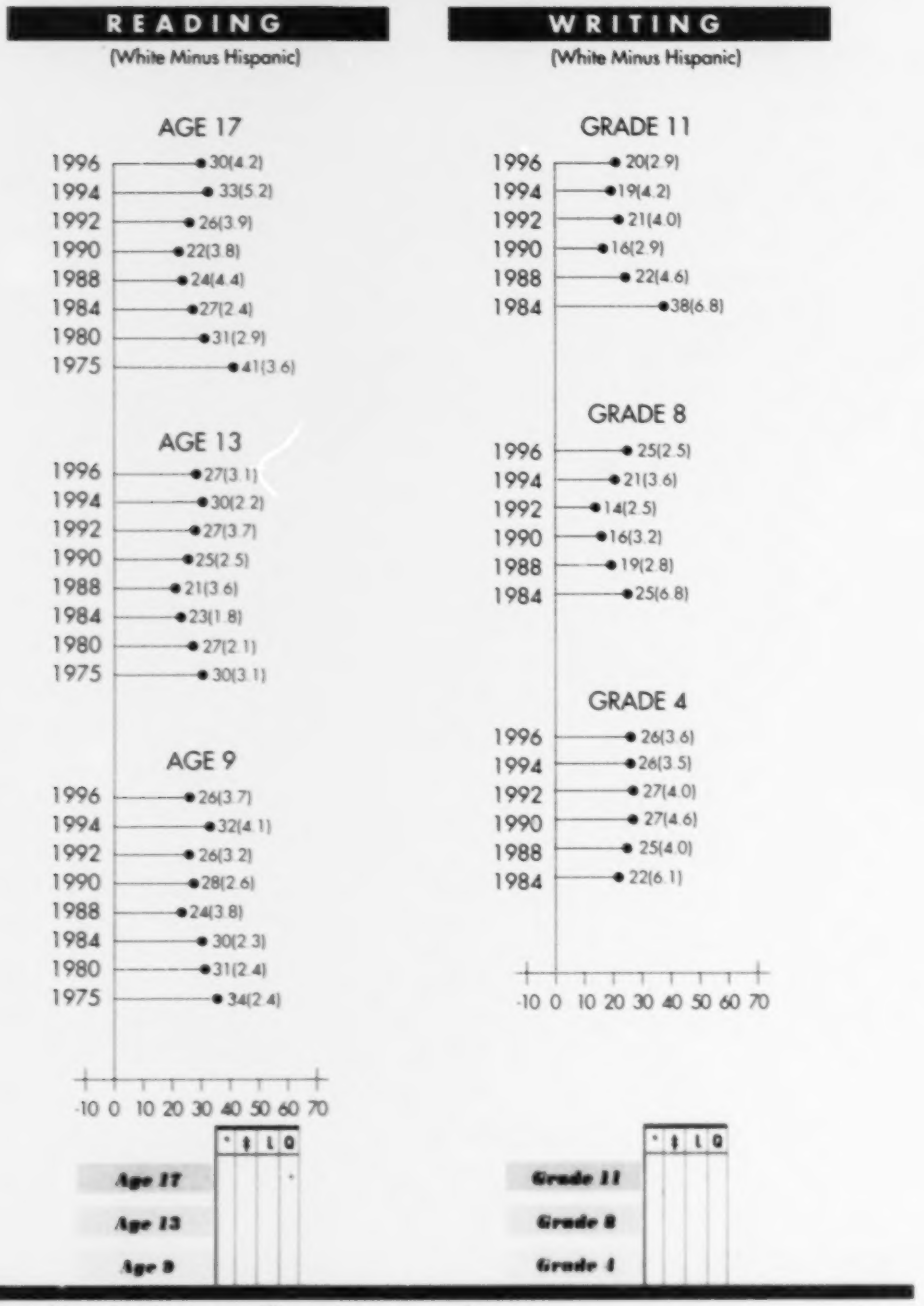

Standard errors of the estimated scale score differences appear in parentheses.

* Indicates that the average scale score in 1996 is significantly larger (+) or smaller (–) than that in the first assessment year.

‡ Indicates that the average scale score difference in 1996 is significantly larger (+) or smaller (–) than that in 1994.

L Indicates that the positive (+) or negative (–) linear trend is significant.

Q Indicates that the positive (+) or negative (–) quadratic trend is significant.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Long-Term Trend Assessment.

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Differences between Males and Females. In 1996, the differences between average scores of male and female students varied across the four subject areas. In mathematics, male students outperformed female students in each age group. In science average scores for male students were higher than those for female students at ages 13 and 17, but there was no significant difference at age 9. In reading and writing, the results were reversed, with female students outperforming male students at each age or grade level. Some changes were observed across the assessment years in the performance differences between males and females in science, mathematics, and reading. However, the trend in writing scale score gaps demonstrates no consistent pattern of increases or decreases at any grade level.

In science, the overall trend at age 17 was one of narrowing gaps between male and female students, due primarily to a decrease that occurred after 1982. As a result, the gap in 1996 was smaller than that in 1969. At age 13, the gap in science scores widened from 1970 to 1982, narrowed again until 1992, but appears to have widened somewhat in the last two assessments. Despite these fluctuations, the gap in 1996 was not significantly different from that in 1970.

In mathematics, the trend at age 17 was toward smaller gaps across the assessments. However, in 1996 the gap between male and female 17-year-olds was not significantly different from that in 1973. Results across the assessment years for 9- and 13-year-olds in mathematics reveal a small but significant shift in the pattern of score differences between male and female students. At both ages, the trend has been away from higher average scores for female students toward higher average scores for male students.

In reading, the gaps between male and female students aged 13 and 17 narrowed between 1975 and 1980, but have fluctuated or increased somewhat since that time. In 1996, the scale score gap for both age groups was not significantly different from that in 1971.

Figure 4

Trends in Differences in Average Scale Scores
Male vs. Female Students

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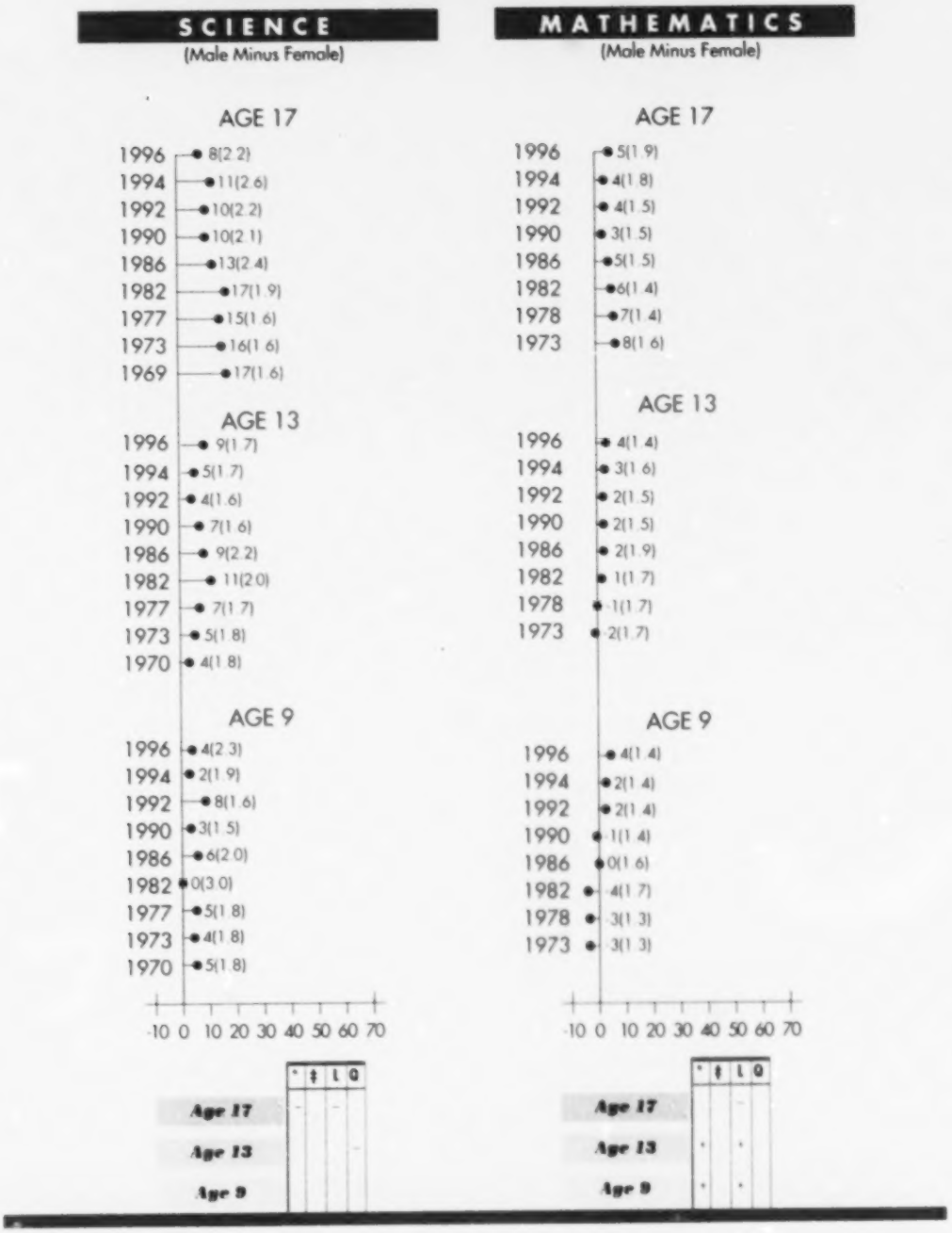

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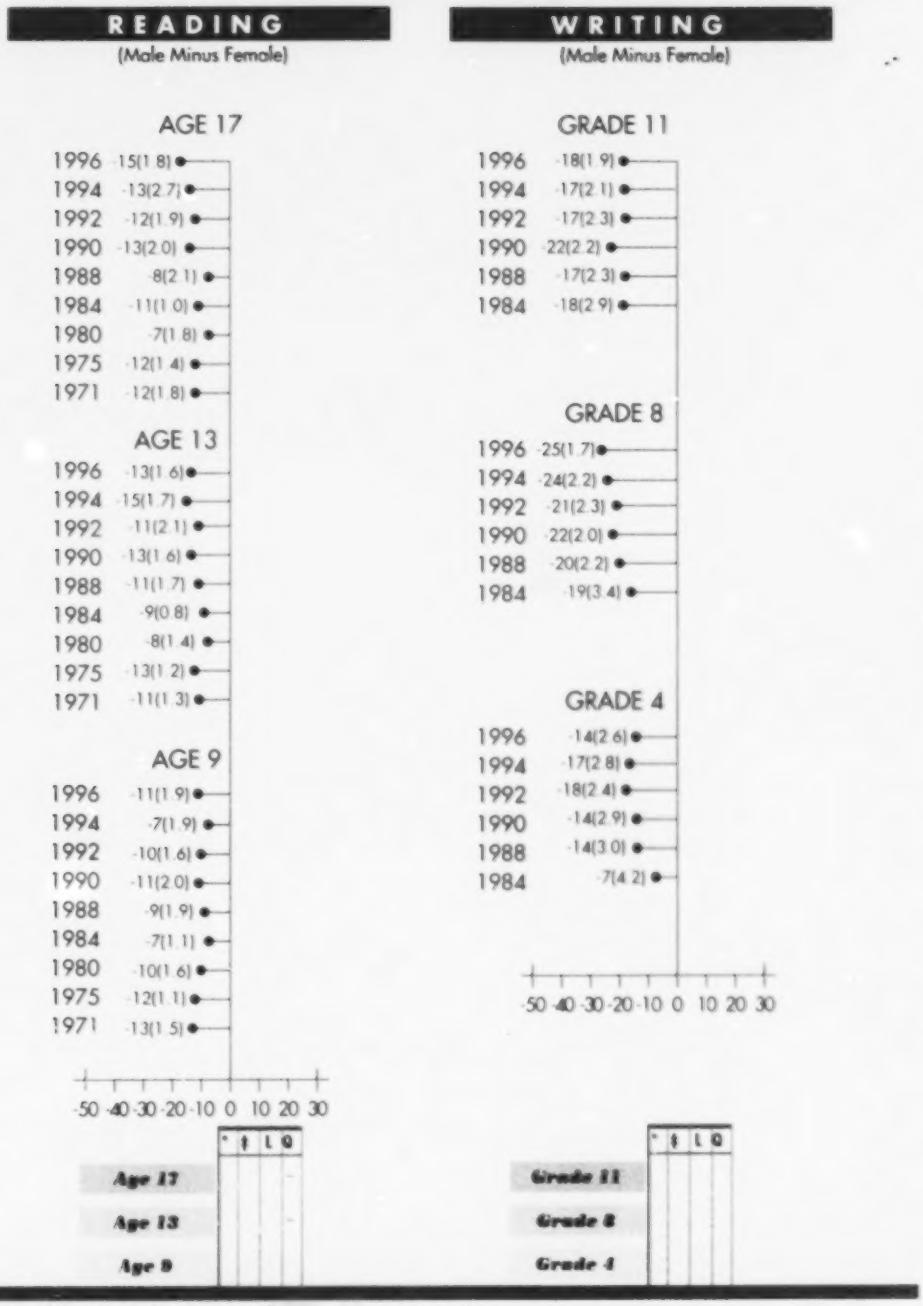
Figure 4 (continued)

Trends in Differences in Average Scale Scores
Male vs. Female Students



Standard errors of the estimated scale score differences appear in parentheses.

* Indicates that the average scale score in 1996 is significantly larger (+) or smaller (–) than that in the first assessment year.

‡ Indicates that the average scale score difference in 1996 is significantly larger (+) or smaller (–) than that in 1994.

L Indicates that the positive (+) or negative (–) linear trend is significant.

Q Indicates that the positive (+) or negative (–) quadratic trend is significant.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Long-Term Trend Assessment.

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Students' Experiences Related to Academic Progress

Students' reports about their school and home experiences related to their learning in the different subject areas provide an important context for understanding trends in academic progress over time. Across the assessment years, NAEP has asked students about these relevant experiences and has examined the relationships between students' reports and their average scale scores. For each school and home factor presented in this report, results from the 1996 assessment are compared with results from the first assessment in which information on that contextual variable was collected.

Science and Mathematics Course Work. The percentages of 13- and 17-year-old students taking more challenging course work in science and mathematics increased over time, although the percentages of students taking the most advanced course work continue to be low.[6] Seventeen-year-old students assessed in 1996 were more likely than those in 1986 to report that they had taken biology and chemistry. However, there was no significant change between the two assessments in the percentage of students who reported taking physics.

Compared to 1986, a higher percentage of 13-year-olds in 1996 reported taking prealgebra and a lower percentage reported taking regular math. As shown in Table 5, there were increases between 1978 and 1996 in the percentages of 17-year-olds who reported that their highest level mathematics course was Algebra II or Precalculus/Calculus. Correspondingly, the percentages of students who reported that their highest level course was either General Mathematics/Prealgebra or Algebra I was lower in 1996 than in 1978.

Table 5 **Highest Level of Mathematics Course Work, Age 17, 1978 and 1996**

	Percentage of Students				
	General Mathematics or Prealgebra	Algebra 1	Geometry	Algebra II	Precalculus or Calculus
1996	8(0.6) *	12(1.0) *	16 (1.0)	50(1.6) *	13(1.1) *
1978	20(1.0)	17(0.6)	16(0.6)	37(1.2)	6(0.4)

Standard errors of the estimated percentages appear in parentheses.

* Indicates that the percentage in 1996 is significantly different than that in 1978.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Long-Term Trend Assessment.

[6] A fuller discussion of science and mathematics course-taking patterns is presented in the *NAEP 1996 Trends in Academic Progress.*

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Technology in the Classroom. Students' reports across the assessment years indicated an increased use of technology. In particular, the use of computers for a variety of classroom activities has risen dramatically.[7] Between 1977 and 1996, there was an increase in the percentage of 9-year-olds who reported using a calculator or thermometer in their classrooms. As shown in Table 6, 13- and 17-year-olds assessed in 1996 were far more likely than those assessed in 1978 to report that they had studied mathematics through computer instruction. Table 6 also reveals increases in the percentages of students in grades 8 and 11 who reported that they had used a computer to write stories or papers. The change in students' use of computers for writing was dramatic — from 15 percent to 91 percent at grade 8, and from 19 percent to 96 percent at grade 11.

Table 6 **Computer Usage in Mathematics (Ages 13 and 17) and Writing Instruction (Grades 8 and 11), 1978/1984 and 1996**

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		Percentage of Students Answering "YES"	
		AGE 13	**AGE 17**
Studied mathematics through computer instruction	1996	54 (1.8) *	42 (2.1) *
	1978	14 (0.9)	12 (1.1)
		GRADE 8	**GRADE 11**
Used a computer to write stories or papers	1996	91 (1.2) *	96 (1.1) *
	1984	15 (3.5)	19 (2.2)

Standard errors of the estimated percentages appear in parentheses.

* Indicates that the percentage in 1996 is significantly different than that in 1978 or 1984.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Long-Term Trend Assessment.

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[7] A fuller discussion of technology use in classrooms is presented in the *NAEP 1996 Trends in Academic Progress*.

Homework. The reports of 13- and 17-year-olds about the amount of time they spent each day on homework did not change significantly between 1984 and 1996; however, some changes did occur at age 9. In 1996, the percentage of 9-year-olds who reported that they did not have homework assigned was lower than the percentage in 1984. Correspondingly, the percentage of 9-year-olds who reported doing less than 1 hour of homework each day increased between 1984 and 1996. However, the percentage of students aged 9 who reported doing more than 2 hours of homework decreased.[8]

Students at all three ages were also asked about the number of pages they read each day in school and for homework. As shown in Table 7, although there were no significant changes in the reports of 17-year-olds, the reports of both 9- and 13-year-old students indicated an increase in the number of pages read each day. Between 1984 and 1996, there was an increase in the percentage of 9-year-olds who reported reading more than 20 pages, and a decrease in the percentage who reported reading 5 or fewer pages. Similarly, the reports of 13-year-olds showed an increase in the percentage of students who read more than 20 pages each day, and a decrease in the percentage who reported reading 6 to 10 pages.

Table 7 — **Pages Read in School and for Homework Per Day, Ages 9, 13, and 17, 1984 and 1996**

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		Percentage of Students		
		AGE 9	AGE 13	AGE 17
More than 20 pages	1996	17 (1.0) *	14 (0.7) *	21 (1.1)
	1984	13 (0.4)	11 (0.4)	20 (1.0)
16 to 20 pages	1996	16 (0.9)	13 (0.6)	14 (0.7)
	1984	13 (0.5)	11 (0.2)	14 (0.4)
11 to 15 pages	1996	15 (0.7)	18 (0.8)	18 (0.8)
	1984	14 (0.5)	18 (0.4)	18 (0.3)
6 to 10 pages	1996	25 (1.0)	31 (0.8) *	25 (1.0)
	1984	25 (0.5)	35 (0.5)	26 (0.6)
5 or fewer pages	1996	26 (1.1) *	25 (1.0)	22 (0.8)
	1984	35 (1.0)	27 (0.6)	21 (0.8)

Standard errors of the estimated percentages appear in parentheses.

* Indicates that the percentage in 1996 is significantly different than that in 1984.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Long Term Trend Assessment.

[8] A fuller discussion of time spent on homework is presented in the *NAEP 1996 Trends in Academic Progress*.

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Home Experiences Related to Learning. Because students' experiences outside of school may have at least as much influence on their academic progress as their classroom experiences, the NAEP trend background questionnaires include questions about home factors related to learning.[9] At grades 4, 8, and 11, a greater percentage of students in 1996 than in 1984 reported using a computer in their homes. Also, a greater percentage of students in grades 8 and 11 reported writing stories or poems that were not for school work at least once a week. However, a greater percentage of eleventh-grade students reported that other people in their family never or hardly ever wrote letters to relatives or friends. Between 1984 and 1996, there were no significant changes in 13- and 17-year-old students' reports about the frequency of reading done by other people in their homes. At ages 9, 13, and 17, students' reports indicated a decrease between 1971 and 1996 in the number of different types of reading materials in their homes.

Past NAEP assessments have shown a relationship between achievement and both reading for fun and television watching. As shown in Table 8, there was no significant difference between 1984 and 1996 in 9- and 13-year-old students' reports about the amount of time they spent reading for fun. At age 17, there was a decrease in the percentage of students who reported reading for fun daily and an increase in the percentage who reported that they never read for fun.

Table 8 **Reading for Fun, Ages 9, 13, and 17, 1984 and 1996**

		Percentage of Students		
		AGE 9	AGE 13	AGE 17
Daily	1996	54 (1.9)	32 (1.9)	23 (2.0) *
	1984	53 (1.0)	35 (1.0)	31 (0.8)
Weekly	1996	27 (1.8)	31 (2.1)	32 (2.7)
	1984	28 (0.8)	35 (1.2)	34 (1.1)
Monthly	1996	8 (1.0)	15 (1.4)	17 (1.5)
	1984	7 (0.6)	14 (0.8)	17 (0.5)
Yearly	1996	3 (0.5)	9 (1.2)	12 (1.6)
	1984	3 (0.3)	7 (0.5)	10 (0.5)
Never	1996	8 (0.8)	13 (1.5)	16 (2.1) *
	1984	9 (0.5)	9 (0.6)	9 (0.6)

Standard errors of the estimated percentages appear in parentheses.

* Indicates that the percentage in 1996 is significantly different than that in 1984.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Long-Term Trend Assessment.

[9] A fuller discussion of home factors related to learning is presented in the *NAEP 1996 Trends in Academic Progress*.

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Students' responses to a question about the amount of time they spend watching television each day show mixed results across the three ages. As shown in Table 9, a greater percentage of 9-year-olds in 1996 than in 1982 reported watching 3 to 5 hours of television every day and a lower percentage reported watching 6 or more hours every day. Although the difference was not significant, the percentage of students who reported watching television for 2 hours or less appeared to increase. These findings suggest that 9-year-olds in 1996 were spending slightly less time watching television than were their counterparts in 1982. The percentage of 13-year-olds who reported watching television 2 hours or less each day decreased, while the percentage who reported watching 3 to 5 hours increased. However, there was a drop in the percentage of 13-year-olds who reported watching 6 or more hours of television. The trend toward increased television watching is more apparent among 17-year-olds. As compared to 1978, a greater percentage of 17-year-old students in 1996 reported watching 3 hours or more of television each day, while a lower percentage reported watching 2 hours or less of television.

Table 9 **Television Watching, Ages 9, 13, and 17, 1978/1982 and 1996**

		Percentage of Students		
		NUMBER OF HOURS WATCHED PER DAY		
		0-2 Hours	3-5 Hours	6 or More Hours
Age 9	1996	47 (1.1)	36 (1.0) *	18 (0.9) *
	1982	44 (1.1)	29 (0.6)	26 (1.0)
Age 13	1996	39 (1.2) *	48 (0.9) *	13 (0.6) *
	1982	45 (0.8)	39 (0.4)	16 (0.8)
Age 17	1996	54 (1.2) *	39 (1.1) *	7 (0.5) *
	1978	69 (0.7)	26 (0.6)	5 (0.2)

Standard errors of the estimated percentages appear in parentheses.

* Indicates that the percentage in 1996 is significantly different than that in 1978 or 1982.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Long-Term Trend Assessment.

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About the NAEP 1996 Trends in Academic Progress

A primary purpose of the National Assessment of Educational Progress is to measure trends in academic performance. This *Report in Brief* summarizes selected results from the comprehensive NAEP 1996 trend assessment. An assessment of the magnitude of the 1996 trend assessment produces many more results than can be presented in this summary report. A more complete discussion of the trend results is presented in the *NAEP 1996 Trends in Academic Progress.*

The full report provides a broad examination of students' learning in the four core academic subjects: science, mathematics, reading, and writing. In addition to the overall results discussed in this report, more extensive subgroup results are presented and topics summarized in this brief report are discussed in greater depth. Specific aspects of students' performance and their experiences at home and in school are reviewed at length. Technical documentation for the assessment is also presented.

Readers interested in further details about the 1996 trend assessment are encouraged to read the *NAEP 1996 Trends in Academic Progress.* The full report can be ordered by writing to:

National Library of Education
Office of Educational Research and Improvement
U.S. Department of Education
555 New Jersey Avenue, NW
Washington, DC 20208-5641

or by calling 1-800-424-1616 (in the Washington, DC metropolitan area call 202-219-1651).

Acknowledgments

This report is the culmination of the effort of many individuals who contributed their considerable knowledge, experience, and creativity to the NAEP 1996 long-term trend assessments. The trend assessments were a collaborative effort among staff from the National Center for Education Statistics (NCES), the National Assessment Governing Board (NAGB), Educational Testing Service (ETS), Westat, and National Computer Systems (NCS). Most importantly, NAEP is grateful to the students and school staff who made the assessment possible.

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